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UNITED STATES DEPARTMENT OF AGRICULTURE
2✓ U.S. FOREST SERVICE
5a WASHINGTON

RD
SUPERVISION
General

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✓³ INSTRUCTIONS FOR FOREST SERVICE PLANT COLLECTIONS //

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Introduction

Forest Service field men work with living plants. One of the handiest tools a Forest Service field officer can have is a good working knowledge of the important plants in his area. Such knowledge aids him in his own job, enables him to help others, and gives him added confidence in his public contacts. The suggestions in these plant collection instructions are offered to help him to such knowledge and to provide convenient channels through which he can contribute to the Forest Service and to the public at large the much-needed, first-hand observations on our basic plant resources.

Field work in the Forest Service is inseparably linked with our living plant resources -- plants of many thousand kinds, of multiple uses, and of imperfectly known potentialities. These plants grow in diverse habitats in widely separated areas on the 152 national forests and additional purchase units and experimental areas, totaling more than 180 million acres in 42 states, Alaska, and Puerto Rico. The range plants have a vast diversity of character and use. They may be grasses, grass-like plants (sedges and rushes), range weeds (forbs), or woody plants (browse) and may be significant as forage for livestock and game or cover for wildlife, valuable for watershed protection and erosion control, or perhaps objectionable as aggressive invaders or poisonous or otherwise injurious. Trees, of course, may serve for lumber, pulpwood, fuel, naval

stores and other products, windbreaks, shelterbelts, ground-cover, mast for game, browse, for ornament, and many other purposes.

The need of knowing plants. Familiarity with the vegetation which produces the range forage crop is essential to the efficient management of range lands. Nearly every phase of range management is intimately associated with a knowledge of the range plants, their values for different classes of livestock, and their requirements. For example, in determining the class of livestock to which a range is best suited the character of forage is the first factor to be considered. In deciding grazing periods the permanent welfare of the range is the fundamental principle. To know whether the range is improving, stationary, or deteriorating; whether the important plants are grazed sooner than they should be; whether key plants are handicapped in the production of a viable seed crop or are being utilized at periods of maximum palatability are among the pertinent questions that demand for their answers acquaintance with the plants themselves. Earmarks of overgrazing and undergrazing, need for fencing and salting, injuries to coniferous reproduction, and livestock poisoning are other phases of range-land management that tie in closely with knowledge of range plants.

Our trees, of course, are more easily recognized than our range plants, since there are about twenty species of range plants for every tree species. Nevertheless, there are still critical tree genera in this country, such as oaks, hickories, and hawthorns, which need further study both in field and herbarium. Much is yet to be learned regarding the distribution, life history, and requirements of our native trees.

Division of Dendrology and Range Forage Investigations. Forest Service research work in dendrology and in the identification, life history, phenology, distribution, habitat, and economic values of native range plants, including standardization of scientific and common names, is centered in the Division of Dendrology and Range Forage Investigations, Branch of Research, Forest Service, Washington, D. C. This division in its present form was established in 1942 to combine the studies on range plants with those on dendrology, or trees. During the interval since the death of George B. Sudworth in 1927 there had been no dendrologist.

Forest Service Herbarium in Washington, D. C. This division maintains the Forest Service Herbarium located in Room 0106, South Building, Department of Agriculture, 12th St. and Independence Ave., S. W., Washington, D. C. Begun in 1910 this herbarium now contains more than 100,000 specimens submitted by forest officers for identification. It is the largest and best annotated collection of western United States range plants and also comprises many plants from other parts of the country and elsewhere. With the expansion of the Forest Service forestry and grazing program in the East and reestablishment of the dendrology project, specimens of eastern plants, including trees, have increased. A cordial invitation to visit the Forest Service Herbarium is extended to all interested in range plants and trees, and especially to foresters on detail to the Washington office.

Why collect plants? Four of the main reasons for collecting plants are:

1. Identification. In such plant-resource inventories as forest, range, watershed, or flood-control surveys, collections are made for the identifications which are basic to preparing local or regional plant lists, records, or publications. These plants are kept as verifiable identification records.

2. Ready source of valuable data. Practical and basic knowledge of plant identities and use values is cumulative and results from the cooperative efforts of both field and office workers. Carefully collected and accurately annotated specimens, when identified and assembled in a central herbarium, furnish a ready source of valuable data, such as forage value and other uses, geographic distribution, range extensions, habitat, and phenology. These data, after synthesis and analysis, serve as a factual basis for publications (such as the Range Plant Handbook), or for plant-resource management or research-project plans.

3. Plant-record checks. Planned, intensive plant collections are made to detect or to check relative abundance and significant plant succession trends or habitat or competition factor changes on areas selected for management or research projects.

4. Study or training. A practical way to learn the important plants in any new area is to collect specimens, accurately note significant field data, verify identifications, and file for ready reference. After fairly representative collections are made, the local officer has a handy reference for identifying plants or of making such practical or ecological regroupings as he needs for study or training purposes. For example, by using variously colored folders he could assemble any such locally important groups as: poisonous plants, key forage plants, indicator (alkali-tolerant) plants, paired important plants frequently confused (for example, the poisonous water-hemlock and the palatable and useful angelica, or a poisonous and harmless astragalus), trees and the showier wild flowers in which the national forest vacationers will be interested, etc.

Regional and local herbaria. Because herbaria prove practical and helpful, they are maintained at experiment-station headquarters and in regional offices, as well as locally in offices of forest supervisors, rangers, research centers, branch stations, and experimental forests and ranges.

Reference collection material especially desired. In order to build up the Forest Service Herbarium as a reference collection, the Washington office especially desires material such as (1) good specimens (preferably with mature fruit) of commercial or other tree species, including those important in forest surveys; (2) any specimens believed to represent range extensions and State records; (3) collections from national forests, experimental areas, and research centers in the eastern and southern parts of the United States; (4) collections from newly established administrative and research units; and (5) specimens of newly described species, varieties, and hybrids known to occur on Forest Service areas.

Why these instructions? The main purposes are: (1) to provide field men ready-reference instructions on general methods of collecting and

annotating plant specimens, and on preparing, maintaining, and using herbaria for study, reference, or training purposes; (2) to establish a simplified, uniform procedure for handling and identifying Forest Service plant collections, thereby saving time and reducing correspondence; (3) to standardize plant names (both scientific and common) within the Forest Service, and (4) to call attention to the renewed interest in tree specimens. This revision, which was prepared by the staff of the Division of Dendrology and Range Forage Investigations, replaces the last mimeographed Instructions for Forest Service Plant Collection (13 pp., illus. [1940]). Grateful acknowledgment is due many field men and others for their helpful suggestions, many of which have been incorporated here. Field criticism and suggestions for later revision of these instructions are solicited.

Why follow instructions? To assure agreement in collections and records, promptness in handling and identifying plant specimens, and uniformity in nomenclature, these instructions should be followed carefully. Adequate and properly prepared specimens insure easier and prompt identification. Even the best plant specimens lose value as permanent records, however, if they are not accompanied by accurately and fully annotated labels. Any special plant collection instructions by the region or experiment station should, of course, be followed in conjunction with these Service-wide instructions.

Special methods. Special methods and details and certain new techniques are beyond the scope of these instructions, but further information may be obtained from the Washington office or from the selected references listed.

Collecting Specimens

Collect specimens in duplicate (two sets) for the Washington office and as many additional sets as needed for regional and local herbaria.

Usually administrative officers collect five sets in all: two for the Washington office and one each for the ranger station, supervisor's office, and regional office. Research officers generally need only four sets: two for the Washington office, one for the experimental forest, experimental range, or research center (as the case may be), and one for the experiment station (director's office); they need only three sets if the director's office has no separate herbarium. Where regional office and experiment-station headquarters in the same territory are not in the same building it will usually prove mutually helpful for those offices to exchange duplicate sets. Such an exchange of collections between an experiment station and a supervisor's office may also be desirable if the experimental area is within or adjacent to the national forest. In such cases the permanent reference value of the additionally required exchange sets, filed in different places, compensates for the extra collecting work involved.

Avoid mixtures. Take care that two or more superficially similar but different species (for example, two different sedges, bluegrasses, bromes, fescues, oaks, asters, or sagebrushes) are not numbered and submitted as one specimen. With perennial grasses, sedges and forbs, and shrubs that produce rootstocks or runners, such mixtures can, when practicable, be avoided by taking all the duplicates from plants on the same rootstock or runner; with large shrubs or trees, by selecting all the duplicates from different branches on the same plant.

Except in special cases, select representative specimens. Flowering or fruiting specimens representative or average for the species usually should be selected. Sometimes, however, it may be desirable to collect unusual or even rare variations, seedlings, juvenile stages, or specimens suspected of being natural hybrids. Attention should then be called to the special circumstances of the collection either in the memorandum of transmittal, on the collection labels, or on separately inserted slips of paper. Material of this sort naturally requires more time and effort for identification than usual herbarium specimens.

Collect plenty of good material. At best, a pressed herbarium specimen is only a 2-dimension representative of a 3-dimension living plant; within the limits of the standard-size herbarium mounting sheet, large plants must necessarily be represented only in part. Each plant specimen should, therefore, consist of enough plant material to represent the species as adequately as possible. Several plants of a small herb are needed to make one adequate specimen; for example, one small, single-flowered violet plant would be insufficient. This is because in a critical or unfamiliar genus dissection of the flower is necessary for identification, so that it is ruined as a permanent record. Small, sparingly branched perennials or shrubs not more than 2 or 3 feet tall should be represented by the whole plant, including flowers or fruit, basal and stem leaves, runners or underground stems, if present, and roots. One or more flowering or fruiting branches, a foot or more in length, would constitute a specimen of a large shrub or tree.

Collect specimens in flower or fruit. As identifications are based largely upon characters of flowers, fruits, and seeds, specimens should, whenever possible, have flowers or fruit or both. It is desirable to collect several extra flowers and fruits for subsequent dissection during identification, if these parts are few. Naming of fragmentary specimens and those with neither flowers nor fruit, is difficult, uncertain, and time-consuming. If collected on different dates, flowering and fruiting specimens should be handled as different specimens (with separate numbers and labels) to avoid possible mixtures, but a note should be added that both belong to the same species (or same plant, if a tree or large shrub). Plant families in which the mature fruit or seed characters are especially important in identification are: Pondweeds, grasses, sedges, rushes, crucifers (mustards), legumes, umbellifers (parsnips), borages, composites, and most families of trees. Specimens without flowers or fruit may be submitted if it is essential to know the name before flowers or fruit can be obtained; in such cases, please note the circumstances of the collection.

Roots, underground stems, and basal leaves. Roots and other underground parts (for example, bulbs, tubers, and rootstocks or rhizomes) are of special importance in the identification of grasses, sedges, onions (Allium), waterhemlocks (Cicuta), and many other plants. These should be extracted carefully to avoid breaking. The adhering soil can be removed by washing, rubbing between thumb and fingers, or by gently tapping or shaking. Basal leaves and rosettes often are diagnostic also, as in Delphinium, Phacelia, and certain Scrophulariaceae.

State laws as to collecting plants. Several States have laws requiring permits to collect specimens; some also have laws or local

restrictions protecting rare plant species. Any Forest Service officers making extensive "off forests" collections in such States should first obtain the proper permits. Likewise, botanists and amateurs should observe the State laws when collecting on Forest Service lands.

Rare species of plants. Whether or not covered by State laws, rare species on national forests and experimental areas should be protected from extermination. Examples are alpine plants isolated on mountain summits and certain herbs with showy flowers. If a species is rare, the roots should neither be collected nor disturbed; if very rare, the number of sets of duplicate specimens should be reduced. The record of a rare species may have special value in geographic distribution.

Sometimes poisonous or otherwise objectionable plants or introduced weeds, originally rare and local, have suddenly become aggressive and of great economic significance. For example, the common St. Johnswort (Hypericum perforatum), a widely distributed weed in the Old World, was so rare and local in the Pacific Coast region less than 50 years ago that it was practically unknown. Today this aggressive and poisonous weed, commonly called Klamathweed in the West, has so infested range lands there that stockmen have suffered great economic losses.

Collecting equipment. Transportation facilities and road and other field conditions naturally will affect or govern the collection methods used and the equipment chosen. A pocket knife or hunting knife is always useful and pruning shears are suitable also for woody plants. For removing roots and other underground parts some prefer a small garden trowel and others a small geologist's pick (fig. 1), or other sharp instruments. If they cannot be pressed when collected, the specimens should be protected from wilting, bruising, and breaking and against the loss or falling off of parts. Botanists often carry a vasculum, which is an oval metal collecting case $1\frac{1}{2}$ to 2 feet long, provided with a tightly fitting hinged flap door and a shoulder strap (fig. 1). A few moist newspaper sheets inside will keep the plants from drying out. In very hot weather a vasculum overheats and so is unsatisfactory. With proper care cans or boxes are also serviceable. Or, when better equipment is unavailable, the specimens may be wrapped in moistened newspapers or leaves or in a slicker or coat, or carried in a pack sack, large paper sacks, etc. Duplicates of the same species may be wrapped or rolled individually or together in newspaper sheets, for example.

Collecting seeds and living plant material. Directions for collecting seeds and living plant material for propagation are covered in other publications. Mirov and Kraebel (29)^{1/} have described the collecting and handling of seeds of wild plants useful in conservation projects. The Forest Service Woody-Plant Seed Manual (17) contains detailed information concerning seeds of trees and shrubs. How to collect and pack propagation material for long-distance shipment has been discussed by Galloway (19) and by Archer (1).

Pressing and Drying Specimens

Specimens are dried promptly under pressure. Pressing prevents wilting or wrinkling and flattens the plant so that it occupies the least space

^{1/} Underlined numbers in parentheses refer to Selected References, pages 25 - 27.

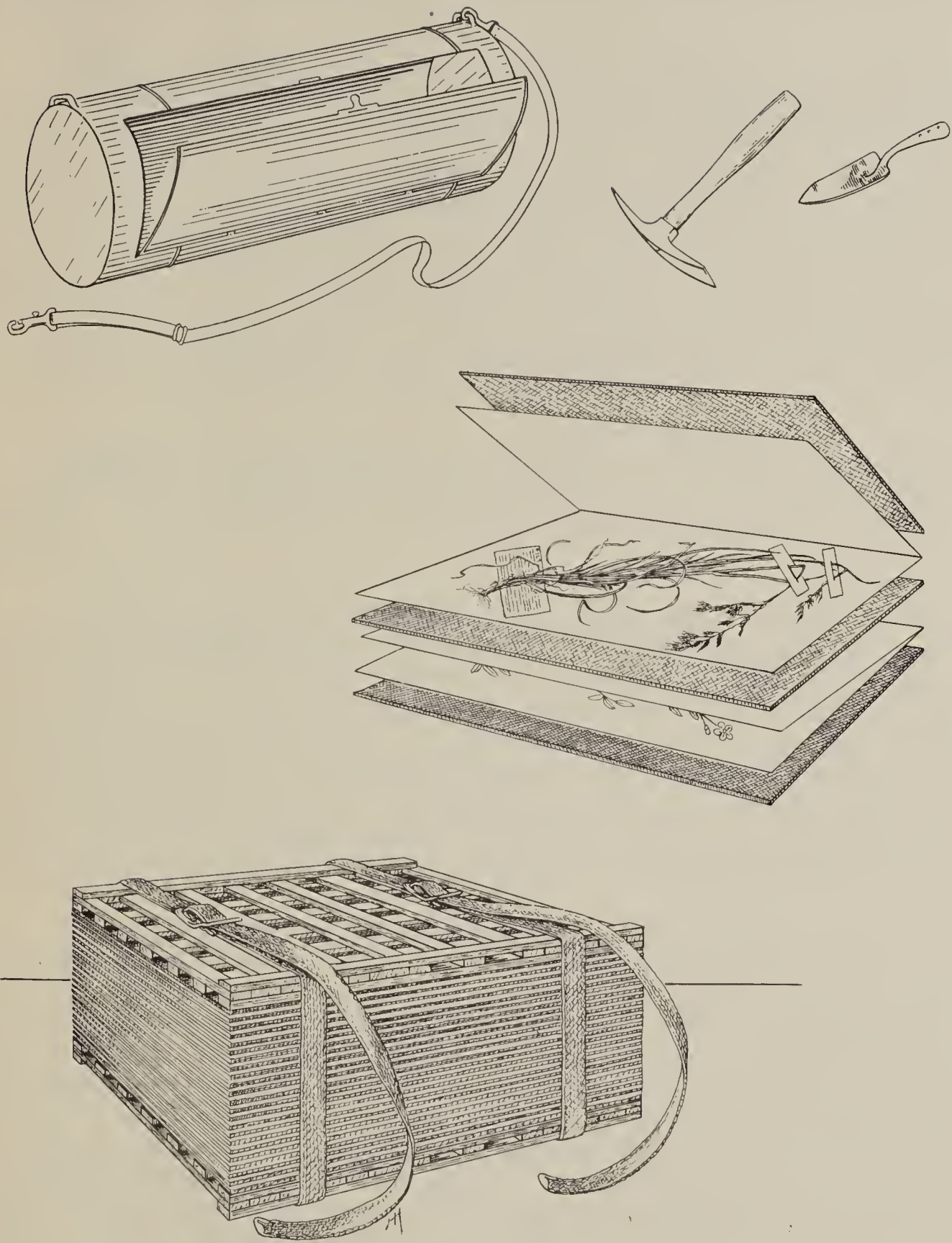


Figure 1. Above, a vasculum for carrying specimens in the field before pressing, and a pick and a trowel for digging up roots and other underground parts. Center, the specimen arranged in a sheet of newsprint with a blotter above and beneath. Below, the plant press with alternating specimens and blotters, showing the frames fastened with two straps.

and can be mounted and stored without breakage. Rapid drying prevents molding and discoloration. The specimens usually are better if pressed in the field as soon as collected. Experienced collectors can choose their favorite equipment and methods. Supplies and equipment can be purchased from Government supply sections or from botanical supply companies (see page 24).

The plant press. The plant press consists of two frames 12 by 17 (or 18) inches in size, usually made of thin, latticed strips or slats of wood, such as ash or oak. Plywood, boards, frames made from laths, or wire shelves from small refrigerators will serve also. Pressure is obtained usually by a pair of webbed straps with buckles. Cotton sash cord, rope, and leather straps also are used. Fifty to 100 or more blotters or driers, made of felt or blotting paper and the same size as the frames, are needed. A roll of "deadening felt", as sold by hardware stores, can be cut into driers of proper size. Pressing equipment can be transported easily in a truck; a lightweight field press with shoulder straps and without blotters can be carried on foot or horseback.

Paper. For convenience in pressing, handling, shipping, etc., place the specimens in folded sheets of newsprint paper $16\frac{1}{2}$ by 23 inches before folding, or old newspapers or similar unglazed paper, rather than directly between blotters.

Arrange specimens carefully in the sheets. Carefully arrange the plant to be pressed in an opened sheet of newsprint resting on a blotter on one frame of the press. Since the standard herbarium sheets are $16\frac{1}{2}$ by $11\frac{1}{2}$ inches in size, all specimens should be within these limits or less. Visualize the mounting sheet at the time. If too large to be pressed in its normal position, the plant should be bent at sharp angles in V, N, or M shape to bring it within the proper dimensions. Grasses should not be bent at the easily broken joints (nodes). A narrow piece of stiff paper with a slit in it holds the bent stem-end in place while drying.

Fill the sheet but avoid crowding. Enough small plants or branches all of the same species, with several extra flowers and fruits if these parts are few, should be arranged together to occupy the sheet, but with sufficient space for the leaves and flowers to be straight and natural. Large specimens will dry faster and press better if some branches and leaves are removed. Trim carefully to retain the natural aspect. Crowded leaves, such as on tree branches, may be pinched or cut off if the leafstalk stubs are left to indicate their position on the stems. Turn a few leaves to show the lower surface. Divide large clumps of bunchgrasses into smaller tufts. Stems, roots, and other parts more than one-quarter inch thick should be thinned on the back or split with a knife. Close the filled sheet of newsprint and write the collector's number on an outside edge or insert a label. Use a separate sheet for each of the four or five duplicates needed.

Place sheets of specimens between blotters. While arranging the specimens in newsprint sheets, place blotters (driers) alternately between the sheets. Though one blotter will serve, it is better to use two together, especially if they are thin or if it is inconvenient to change them often.

If a specimen contains both thick and bulky parts (such as woody twigs and fruit) and thin and delicate parts (such as flowers), insert folded newspaper padding or wads of old cotton over thin parts to equalize pressure and keep surfaces level within the press.

Fasten straps securely on the press. After the specimens are in the press, place a blotter and the second frame on top, and fasten the two straps or ropes around the press. Tighten the straps securely to prevent wrinkling of specimens but not enough to crush and damage delicate, succulent plants by too much pressure.

Change blotters often to hasten drying and to prevent mold and discoloration. Put the plant press in a warm dry place with good circulation of air (such as in the sun, near a stove, or in front of an electric fan.) Moisture from the plant specimens is absorbed by the blotters which must be replaced frequently by dry blotters. From 12 to 24 hours after the plants have been placed in the press, the blotters should be changed. At this time, while they are still moist, the specimens should be examined. Any poorly arranged specimens should be straightened and folded or crumpled leaves laid flat and spread out. It is unnecessary to change the newsprint sheets unless they become very wet or moldy. Dry the damp blotters before using again; place in the sun, near a stove, or spread out in a room against the walls and on the floor. Change the blotters regularly each day or, if the plants are juicy and watery, twice daily until the specimens are dry. The drying time depends on how bulky and succulent the plants are and on the drying method used; a week usually is sufficient. A simple test is to bend a leaf; if it breaks, the specimen is dry.

Storage of unmounted specimens. As the specimens become dry remove these sheets from the press and store them in a dry place, safe from rodent and insect damage and from breakage. If long storage is contemplated, insect-repellent chemicals such as paradichlorobenzene crystals or naphthalene (flakes or moth balls) should be scattered among the specimens. The sheets may be placed in unused compartments of herbarium cases or in cardboard cartons of proper size, or tied in bundles covered with wrapping paper. Tarpaper should not be used because it may damage the specimens by reacting with the insect-repellent chemicals.

Special Methods of Drying and Preserving Specimens

Selected references. Additional suggestions on collecting and preserving specimens and on preparing a herbarium may be found in reference books on systematic botany or plant taxonomy (21, 31, 34) and in separate pamphlets, bulletins, and articles (3, 11, 14, 18, 20, 22, 24, 32, 33, 35).

Emergency presses. A plant press can be improvised from newspapers and weights. The specimens in folded newspaper sheets are pressed between pads of several thicknesses of newspapers which serve as blotters, being changed and dried daily. A board and weights (such as books, bricks, or rocks) are placed on top. An old catalog or a magazine, preferably one with unglazed paper, can be used for a press also.

Restoring improperly dried specimens. Occasionally specimens dry before they can be pressed or are improperly dried or are in poor condition.

If valuable, they can be restored by immersion in a tray or pan of hot water until the leaves are softened and can be spread out without breaking. After the excess water is drained off, these specimens can be pressed as though fresh. If no hot water is available, a few minutes soaking in cold water containing a teaspoon or so of a good detergent washing powder and then rinsing with clear water, will also restore most specimens.

Succulent plants. One method of handling plants with fleshy leaves or stems is to dip them in boiling water for a minute or less to kill and soften the tissues before pressing. The flowers should not be immersed. If not killed first, some succulents continue to live and grow after being pressed and mounted. Succulents can be dried rapidly and with good preservation of color by sprinkling salt over the surface (2). Extremely succulent plants, such as cacti, should be split and hollowed out with a knife and then heavily salted. The water which soon collects is removed before pressing. Naphthalene flakes can be sprinkled over a succulent plant also, to aid drying and prevent molding. Cuts or slits in thick, fleshy leaves will hasten drying.

Large cones and fruits. Large cones as well as walnuts and other large fruits should not be pressed, because these bulky structures interfere with pressing of the specimens around them and afterwards waste space mounted on herbarium sheets. Instead, place large cones and fruits temporarily in paper sacks, envelopes, or small boxes, or tag and number to correspond with the specimen. Smaller and softer cones, such as those of hemlocks and spruces, and tree fruits such as acorns and most hickories may be left attached. However, as there may be some breakage, detachment, and loss in pressing, several extra cones and fruits should be collected and saved in numbered envelopes to be inserted with the specimen after pressing.

Spruces and hemlocks. The needles of spruce (Picea) and hemlock (Tsuga) fall off the cut branches upon drying because of continued growth of the basal layer which promotes shedding. If freshly cut branches are placed in boiling water for a minute or more before pressing, the tissues will be killed and most needles will stay attached.

Aquatic plants. Specimens of delicate aquatic plants can be prepared by floating in water first. A piece of mounting sheet or other good-grade white paper, such as linen ledger, is placed beneath, then is lifted out supporting the plants in natural position and allowed to drain. Next, a piece of cheesecloth is placed over the plants to prevent paper or blotters from sticking, and the plants on the paper sheets are pressed in the usual way. After drying the cheesecloth is removed and the paper sheet with specimen now firmly attached can be glued to a herbarium mounting sheet.

Ferns. Ferns should be collected at maturity, usually indicated by brown dots or lines (sori) on the underside of the leaves or leaf margins. Unless rare or large, whole plants including underground parts should be pressed with some lower and upper leaf surfaces exposed.

Lower plants (non-vascular cryptogams). In special studies it may be important to collect algae, fungi, lichens, liverworts, and mosses. The

Washington office will arrange for their identification. Fruiting or reproductive stages of lower plants usually are necessary. Algae may be preserved dry in the manner described above for delicate aquatic plants. Methods of collecting and preserving fungi have been described by Derr and Lane (11). Lichens, liverworts, and mosses are placed in pockets of folded paper or envelopes which, after the specimens are dried in a plant press, are glued to mounting sheets or filed in boxes. For certain studies the more delicate cryptogams may be preserved in vials or small bottles of 5 to 10 percent formalin (1 part commercial 40 percent formaldehyde with from 19 to 9 parts water). The vials or bottles should be tightly sealed and labeled or numbered. If extensive collections of lower plants are planned, it is suggested that the collector write to the Washington office or to a specialist in the particular group for additional information on collection and preparation of specimens.

Drying with artificial heat. The drying process can be hastened and changing of blotters can be eliminated by use of ventilators and artificial heat. This method is recommended for very moist regions, whether hot or cold, and in general when specimens are collected in large quantities. The ventilators are made of metal or cardboard the same dimensions as blotters but with corrugations across their width to permit heat to pass through the press and remove moisture rapidly. Aluminum or other metal corrugates are much more satisfactory than corrugated cardboard because of their rapid conduction of heat, their durability, and their compactness. Arrangement within the press varies with the user (5). Two common arrangements are: Aluminum corrugate, specimen in folded sheet, blotter, specimen in folded sheet, aluminum corrugate, etc.; aluminum corrugate, blotter, specimen in folded sheet, blotter, specimen in folded sheet, blotter, aluminum corrugate, etc.

The press, with straps very tightly fastened, is hung usually on a framework, boxes, or other support at a safe distance above the source of heat, so that the hot air passes through the transverse corrugations. An electric heater or light bulbs, a portable gasoline camp stove, kerosene lanterns, or a kerosene stove may be used. A cloth skirt usually is placed around the heater and bottom of the plant press to prevent loss of heat. An ample opening must be left, however, near the floor level for intake of air to support combustion. Of course, great precautions must be taken against fire. The heater must not be left unattended. Some kerosene stoves tend to flare up within a short time after adjustment and become fire hazards.

It is better to press the specimens first in an ordinary press without heat for 12 hours or more and then to straighten any wrinkled or folded specimens. Following that, 12 hours in a press with artificial heat should be long enough to complete the drying process for most specimens. At the halfway point the straps should be tightened again and the press turned over. Though heat can be applied from the beginning, specimens so dried tend to be brittle and to break easily (5,12). Also, if the temperature is too high, the specimens may become brittle or discolored.

Numbering

Each collector has one continuous series of numbers. These collector's numbers, which appear on the labels and are used by botanists citing the specimens, are permanent and more or less continuous throughout life and must not be changed or removed. As some specimens may be discarded and others not submitted for formal identification, the numbers will not form an unbroken sequence. Collectors should not repeat or duplicate their numbers by beginning each season with No. 1. If there is no record of the last number used, assign the next specimen a number sufficiently high to avoid duplication. Gaps, even of one hundred or more, are permitted but repetitions are not. For specimens collected jointly by two or three persons, use the numbers of the person listed first.

Forest, station, or other field numbers. If desired, additional national-forest, experiment-station, or other field numbers may be assigned and added to the labels below the collector's number. Joint collections sent in as one collection from a national forest or experimental area with collectors' numbers overlapping should either have the numbers modified by a prefixed initial or else be given forest or station numbers in addition, so that a report on the collection will be free from ambiguity. Otherwise, when the report is received from Washington, misunderstanding may ensue. Utmost precaution should be taken that the numbers on labels and specimens of the duplicate sets retained in field offices correspond exactly with those submitted to the Washington office.

Labels and Notes

Kinds of labels. The standard label for Forest Service specimens is Form FS-767 (fig. 2), prepared primarily for range plant specimens. It is suitable also for herbs and shrubs in general and can be used for trees. Form FS-707, prepared for tropical trees collected by special projects during the late war, is being revised to serve as a general label for tree and other dendrological specimens. In the meantime, Form FS-767 may be used for tree specimens with space under "Other data" used for notes on height, diameter at breast height (D. B. H.), bark characteristics, uses, etc.

Labels for special purposes. Form FS-130, a smaller, blank label was intended originally for specimens with very limited collection data but is also suitable for specimens collected for special purposes, such as parasitic fungi and lower plants generally. Another label (Form FS-48-R. 8) is used for tropical plants by the Tropical Region.

Detailed field notes should be recorded on the label. Special effort should be made to obtain accurately, and at the time of collection, the essential data for each specimen and to record them as completely as possible on the label, Form FS-767 or Form FS-707. These notes should be written on the spot, either on a pad of labels carried in the pocket or in a field notebook. A specimen without the notes is of little value. However, it is more important that the data be accurate than that the form be filled completely by guessing. It is realized that many specimens are submitted because they are unfamiliar and their economic values unknown.

Form FS-767 (or Form FS-707) should accompany each specimen. This label properly filled out, so that it is entirely self-explanatory, should

be placed inside the folded sheet with every specimen submitted for identification. This label should be prepared so that it may be mounted permanently with the specimen. It may eventually be consulted by many persons, both within and outside the Forest Service; therefore, it should be accurate, legible, neat, (typewritten, if possible), and readily intelligible.

Form FS-767
(Revised 1948)

FOREST SERVICE HERBARIUM
U. S. DEPARTMENT OF AGRICULTURE

100221

Collector's No. B-181

Forest, Sta., other Field Nos. 1352 Date collected September 6, 1948

Bouteleua curtipondula (Michx.) Torr.

(Botanical name) Frances C. Weintraub (Common name(s)) Side-eats grama

(Determined by) Arizona Forest and Range Expt. Sta. SOUTHWESTERN

State Gila National Forest TONTO

County Mystery Spring, Sec. 11, T. 5 N., R. 13 E.

Locality 4700 ft. Slope 10% S. Soil Shallow rocky, gravelly

Altitude Oak woodland Browse 0.3

Vegetation type Quercus emoryi, Q. turbinella, Bouteleua

Principal associated plants hirsuta, Muhlenbergia sp. Use Close

Distribution Openings in woods Abundance Common

Forage value 60% (Where generally found) Very good C. & H. Yearlong

Notes 1 1/2 ft. (Plant use factor) Perennial (Palatability) Aug.-Sept. (Season grazed)

Oct.-Nov. (Usual size of plant) Anthems orange-red when flowers open (Flower color) Aug.-Sept. (Flowering period)

Collector's name James W. Blank (Other data)

16-56647-1 GPO

Figure 2. Label (Form FS-767) correctly and adequately filled out.

How to fill out Form FS-767 (or Form FS-707). Symbols or ambiguous abbreviations (especially for associated plants) should be avoided. The data should, if possible, be condensed so that they will come within the spaces provided. Enter the botanical name, or scientific name, if known or if a tentative field identification to genus or species has been made. Likewise, add the local common name, if any. Indicate slope clearly in degrees or percent. Forage value of range plants may be expressed as "excellent," "good," "fair," "poor," or "none," rather than as an exact percentage, if the plant use factor is not known. Give the full name of the collector or collectors, rather than mere initials or surname only.

Locality. Most Forest Service specimens are collected on or near national forests and experimental forests and ranges, which should be named in the space provided on the labels. The locality, of course, refers to the place where the specimens were growing, not to the collector's address. It should be definite enough to relocate the plants easily if additional specimens are wanted later. Plants from outside the boundaries

of a national forest but not more than about 2 townships' distance (12 miles) should, wherever possible, be tied in to that forest, by adding "(near the)" after the name of the forest. Specimens collected at some distance from the boundaries of a national forest will constitute a separate, "off forests" collection and should be designated on the label by "OFF FORESTS" in the space provided for name of national forest. Good judgment will determine the category in which borderline specimens are placed. Some experiment stations have subdivided their areas into States or parts of States. Experiment-station collections should bear the station name in the space provided and, if from a special unit, the name of national forest, experimental forest or range, etc., inserted in the space for national forest.

Other notes. Any distinctive plant characters that are obvious in the field but which would not be apparent in the pressed specimen should be noted on the label in the space provided for "Other notes". For example, whether a woody specimen is a tree, shrub, undershrub, or vine; the color of flower or fruit when fresh; if the plant is cultivated, introduced, or adventive; the presence of a waxy coating ("bloom") on stems, leaves, or fruits; whether sprouting occurs after fires, etc. Information on flower color is very helpful and sometimes almost essential for identification. Additional items especially important in certain regions, such as soil stabilization or watershed values, or soil type and series, should be added here as desired. Further notes about important plants should be typed single-spaced on one side of good-grade white paper the same width as the label, for permanent mounting with the specimen.

Transmittal of Collections and Review by Region or Experiment Station

A plant collection should be limited to one Forest Service or geographic unit. Each collection of plant specimens forwarded to the Washington office for identification should be composed of plants from one particular Forest Service unit, such as within a -- including "(near the)" -- national forest, experimental forest, or experimental range, or if "OFF FORESTS" from a State or part of a large State. Plants from more than one national forest, experimental forest, or experimental range, or plants from widely separated parts of a large State or from different States must not be combined but should be submitted as separate collections with separate memoranda of transmittal. These distinctions are important for purposes of correspondence, distribution records, filing of specimens, etc. However, it is permissible and often desirable to ship several collections (especially if small) to the Washington office in the same package.

Shipping specimens. Collections of pressed plant specimens must be packed carefully to prevent damage from breakage, bending, shaking, and movement during shipment. A good method is to place the folded sheets between two slightly larger sheets of corrugated fiberboard, heavy cardboard, or similar stiff material. Maximum stiffness is obtained if corrugation ridges run lengthwise of the package. The package should be tied firmly and securely or fastened by strips of gummed brown paper and then well wrapped with wrapping paper. If the bundle is large, additional pieces of corrugated cardboard or a cardboard carton of proper size should be used.

Procedure within region or experiment station. Usually one set of specimens will be retained in the original field office, such as the ranger station, and another in the supervisor's office, while the remaining, unmounted sets will be forwarded promptly to the regional office. In experiment stations, one set usually will be kept at the experimental area or research center and the remaining, unmounted sets will be sent to the director's office.

Review by regional office or experiment station. Collections should be reviewed by some competent person in each regional office or experiment station before submittal to the Washington office. At this time there will be removed common plant material, such as yarrow, dandelion, and fireweed, which can readily be identified by the reviewer or which has been submitted previously from the same national forest, experimental forest or range, or other unit, as well as plant material which is improperly prepared or so fragmentary or incomplete that identification cannot be made. Forms FS-767 (or Forms FS-707) should also be checked. If essential field data, such as locality, altitude, and date of collection are omitted, the form should be returned to the collector for completion. In forwarding the collection for review, the collector may designate any important or unusual specimens for which he especially desires identification through the Washington office. Incidentally, the Glossary of Botanical Terms Commonly Used in Range Research (9) will be a useful supplement to the botanical manuals for field identifications.

In general, with exceptions noted below, each species should be submitted to the Washington office only once from each national forest or similar unit. Where positive identification can be made in the field, additional specimens of species (especially if common and readily identifiable) previously identified through the Washington office should not be submitted later from the same national forest. This suggestion is intended primarily to avoid crowded herbarium conditions and to save time in handling material and does not apply to difficult groups, such as grasses, sedges, composites, etc., or to any specimens for which the collector requests forwarding to Washington. Also, other specimens of a species from the same national forest may be submitted whenever they represent a definite and important increase of knowledge, such as: (1) Taxonomic, ecological, and habitat variations within the plant species; (2) range extensions; (3) additional growth stages, such as to show both flowers and fruit; (4) additional economic notes or other important data; (5) distribution records of rare or local species; and (6) a special research project.

Two sets of duplicate specimens, unmounted, are sent to the Washington office. All specimens submitted by regional offices and experiment stations to the Washington office for identification should be in duplicate, that is, two folded newsprint sheets and two labels for each collector's number. One set will be mounted and filed permanently in the Forest Service Herbarium in Washington, D. C. Specimens in certain plant families from the other set will be sent to cooperating specialists, who retain the material in return for identification.

In general, specimens sent to the Washington office will not be returned. If only one specimen is collected, as in the case of a very rare species, it may be photographed in the Washington office and prints sent to the field offices.

Collections should be sent in currently. Specimens submitted promptly at the close of a field season can be identified and reported upon in most cases before the beginning of the next field season. However, collections may be forwarded at any time. Whenever names of limited numbers of specimens are desired by a field party for its records before the close of the season, prompt identifications should be requested and usually can be given.

Size of collections. For ease in handling and identification in the Washington office, an ideal collection consists of about 50 to 100 specimens. Smaller collections involve the same amount of correspondence and routine records as larger ones and tend to increase cost of handling per plant. However, small collections should not be held over for others but should be submitted when ready. It is undesirable to hold collections from one year to another. Bulky collections of 300 to 400 or more specimens covering several years' work tend to delay identification and may involve lost motion in arrangement for listing and other handling phases.

Memorandum of transmittal. The memorandum of transmittal for each plant collection sent to the Washington office should contain the following information: (1) Name of the national forest, experimental forest or range, geographic unit, etc., where the plants were collected; (2) total number of specimens submitted; (3) names of collectors; (4) a statement as to the collectors' numbers or other numbers being sent; and (5) a list of numbers and names of plants identified in the field and removed from the collection before submittal to Washington. A copy of the memorandum of transmittal should be enclosed in the package of specimens. For purposes of distinction, when two or more shipments with the same designation are made at one time, the memorandums of transmittal should not be dated the same day, but rather consecutively, as September 30, October 1, October 2, etc.

Designation of Correspondence and Material

File designations of correspondence. Most correspondence probably should be filed under "range plants", as in the past, since most plant collections submitted are chiefly range plants or herbs and shrubs from western United States. The following file designation illustrates a collection from a regional office: RD, R-2, RANGE PLANTS, Identification, Arapaho. A collection made on a national forest but submitted by an experiment station may be referred to as follows: RD, R-1(NRM), RANGE PLANTS, Identification, Gallatin. An experiment-station collection made off the national forests may be designated in this manner: RD - CAL, RANGE PLANTS, Identification, San Joaquin. However, collections primarily of trees from those regions and experiment stations without active projects in range management or range research may be classed under "dendrology" in correspondence. An illustration would be: RD - NE, DENDROLOGY, Identification, Lebanon. In each case the end term of the designation is where the plants were collected, rather than the name of the sending office.

Packages. Each package containing plant specimens submitted to Washington for identification should be addressed to Chief, Forest Service, Washington 25, D. C., and for the attention of the Division of Dendrology and Range Forage Investigations.

Identification of Specimens

Identifications made in or through Washington office. It is advantageous to the entire Forest Service that the Washington office should serve as a clearing house for plant identification: (1) To promote a consistent and uniform nomenclature; (2) to enable collection and analysis of range plant and dendrological data; and (3) to furnish information of this sort to the field. Plant specimens submitted to the Washington office are identified by the Division of Dendrology and Range Forage Investigations and with the assistance of cooperating specialists. The Forest Service is regarded as the authority for nomenclature of forest trees in the Department of Agriculture. Therefore, to be authoritative and suitable for use in technical publications, identifications made in the field or locally by outside specialists should be submitted through the Washington office for review.

Uniformity of scientific names. By identification through the Washington office, botanical or scientific names will be uniform in the Forest Service and its publications. Thus, standard, up-to-date nomenclature under the International Rules of Botanical Nomenclature (4, 6) and in accordance with the latest monographs can be maintained.

Identifications by local specialists. Any specimens identified by local specialists, such as botanists and foresters of cooperating universities and colleges, should be forwarded to the Washington office in the usual way, but with mention of the persons making the identifications. In this way the Forest Service Herbarium in Washington will have the benefit of the identifications by local specialists as well as of the duplicate specimens. Also, any discrepancies in names (such as may arise from using the various local manuals and floras published over a period of years and sometimes under different codes of nomenclature) can be more readily adjusted. As the Washington office already has arrangements with recognized specialists in many plant groups, specimens for these authorities should be submitted through this office rather than direct. Also, any local botanists and foresters who collect on the national forests and experimental areas should be encouraged to deposit named and labeled sets of these specimens with the Forest Service, preferably one set for local use and one set for the Washington office.

Changes in identifications. Changes are sometimes made in the identifications reported by the Washington office, such as after a new taxonomic monograph appears, after review by a specialist in a critical genus or family, or when errors are detected. These changes are reported to the field offices and should be entered on the labels of the specimens involved and likewise in the appropriate records. Similarly, it will be appreciated if field offices will report any errors, questions, or changes resulting from the identifications or differences in interpretation of specific limits.

Why names change. Many persons who are not systematic botanists may be puzzled by changes in scientific names which seem to be all too frequent. Though one of the essential points in nomenclature is fixity of names, unfortunately some changes in scientific names do occur. Formerly, two rival codes of nomenclature were used by the botanists of this country, but in 1935 the best features of both were combined. When the Department of Agriculture adopted the International Rules of Botanical Nomenclature (4, 6) in 1940 in place of the American Code, various changes

in names used by the Forest Service became necessary. Among these was acceptance of a list of conserved generic names (nomina conservanda), such as Carya instead of Hicoria for the hickories. Some name changes, especially of species, are simply due to better understanding of a plant group, often resulting from detailed field, herbarium, and experimental researches. Other changes are corrections of misapplications of names made after the original specimens, or types, are examined, while a few result from the discovery of obscure, though valid, names of earlier date than those in current use.

Type specimens. Any Forest Service specimens designated as type specimens of new species, new varieties, new hybrids, etc., are deposited in the United States National Herbarium which is a division of the United States National Museum, and located in Washington, D. C. Here these valuable specimens, upon which the names and descriptions are based, are properly stored together and available for reference. The duplicate specimens of the type, that is, those with the same collector's number, are almost equally valuable and are known as isotypes. Forest Service field officers discovering and describing new plant entities are requested to submit their type specimens to the Washington office to be deposited permanently in the United States National Museum.

Reporting on Collections

Report of identifications by Washington office. When the plant collection has been identified and reports from cooperating specialists have been received, the Washington office will furnish the regional office or experiment station with as many copies of the identifications as are required. One copy will be retained in the regional or experiment station office. The other field units involved, such as supervisors' and rangers' offices or experimental areas, as well as the collectors, will be furnished with copies.

The list of identifications will be arranged by four forage groups, each alphabetically by scientific names: (1) grasses; (2) grasslike plants (chiefly sedges and rushes); (3) nongrasslike plants (exclusive of trees and shrubs), that is, nongrasslike herbs, or forbs, and lower plants; and (4) trees and shrubs (browse). Any first Forest Service records will be indicated. Outside specialists making identifications are stated. Authors of species and varieties listed in the manuals and floras are omitted unless requested by field offices. However, authors of names not found in manuals, such as new combinations, etc., are furnished.

Economic notes. In the past, economic notes on various western range species were prepared in the Washington office and were furnished field offices as photostatic prints. These notes in card form for several thousand species are still available. However, economic notes on most grasses and many shrubs and other important range plants now are in print (8, 10, 15, 23, 36). Various State and regional publications contain further information.

The Herbarium

Methods of preparing herbaria vary. A herbarium is a collection of dried and pressed plant specimens mounted and permanently arranged in cases for reference, study, or training purposes. Different methods of mounting and filing specimens are in use; a uniform policy in this matter

seems impractical. The more common methods are given here and additional details may be obtained through correspondence with the Washington office or from several of the references cited (20, 21, 24, 26, 32, 33, 34).

Specimens should be mounted upon identification. As soon as the identifications from the Washington office are received, the pressed specimens should be mounted and filed in herbaria of field offices in accordance with the region or experiment station policy (fig. 3). On the label (Form FS-767 or FS-707) should be added the botanical name (scientific name), the approved common name (if available), and the Forest Service Herbarium number (Washington office serial number). It is desirable that the name of a specialist making an identification and any other notes in the report be added. The label is pasted in the lower right corner of the mounting sheet.

Mounting sheets. Standard mounting sheets are of thick white ledger paper, $16\frac{1}{2}$ by $11\frac{1}{2}$ inches in size. However, in field herbaria where sufficient space is available and the specimens subjected to considerable use, a heavier white cardboard mounting sheet or Bristol board, cut to the standard size, may be preferred.

Methods of mounting. Specimens are firmly and neatly attached to mounting sheets by means of narrow gummed cloth strips or by gluing. In the Washington office gummed cloth strips are used. Some field offices prefer gluing, a quicker and cheaper method, but objectionable because the specimens cannot be removed for study (or for remounting) and may break more easily or in time may become loose. Both methods may be supplemented by sewing of thick or heavy plant parts.

Vary the position of specimens on the mounting sheets. It is important to vary the position of specimens on the mounting sheets, so that they will fit and stack together better and occupy less space in the herbarium cases. For example, some large and bent specimens should be placed with the roots at the bottom and others with the roots up. Not all specimens should be in the center; some should be mounted at one side of the sheet.

Mounting specimens with gummed cloth tape. Thin white gummed cloth, known also as gummed linen tape, is available in rolls of widths from $\frac{3}{4}$ inch to 6 inches. A number of narrow strips $\frac{1}{16}$ to $\frac{1}{8}$ inch or more in width and of different lengths can be cut quickly on a paper cutter or with scissors or a razor blade in a holder. These strips are attached at right angles across roots, stems, leaves, flowers, and fruits, as needed, to fasten the specimen securely. A moistened strip, such as across a stem, is pressed firmly to the mounting sheet and held on both sides of the plant part by pressure of curved botanical forceps or tweezers or by the thumb nails, until rigidly attached. Care should be taken that the ends of the specimens are rigid; strips should be placed near the cut ends of twigs and stalks, which are easily pried off or broken in handling. Both the upper and lower leaf surfaces should be visible; hence, if necessary, one or more leaves should be turned. Other kinds of gummed tape or paper lacking permanent adhesive qualities are not satisfactory.

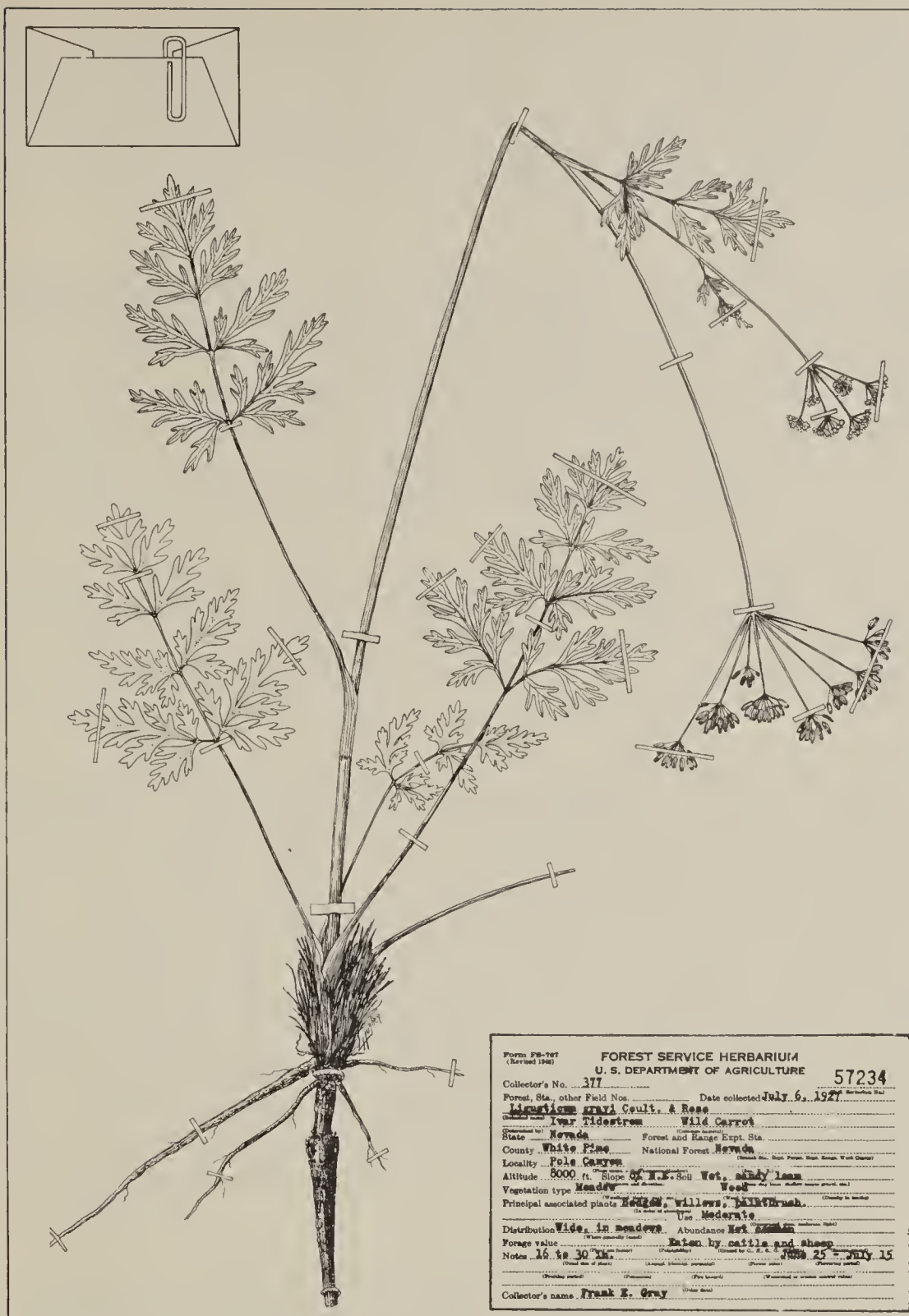


Figure 3. Complete specimen with flowers, fruits, and roots properly mounted on a standard herbarium sheet (11 1/2 by 16 1/2 inches) here reduced one-half: Note the strips of gummed tape neatly and inconspicuously placed to fasten the specimen securely. The top root is sewed to the sheet. Additional fruits for study are contained in the pocket of folded paper in the upper corner.

Sewing. In addition to the gummed cloth tape, thick and heavy mounts, such as woody specimens, may require sewing with green or brown linen carpet thread to make them secure. Large and matted grass roots are sewed with brown thread, with the stitches concealed as much as possible. The thread is tied on the underside of the mounting sheet, and a piece of gummed cloth placed over the knot to prevent damage to the specimen filed beneath.

Mounting by gluing. First, spread a thin layer of carpenter's glue on a piece of plate glass with a putty knife or small paint brush. Drop the specimen onto the glue, then once or twice upon a newspaper sheet to remove excess glue, and finally set in position on the herbarium sheet. Mounted specimens should be dried between sheets of glazed cardboard and under some pressure. After the glue is dry the mount should be examined carefully and reinforced with gummed strips or thread.

Pockets. Enclose small loose material, such as flowers, fruits, seeds, and leaves, which may be needed for further study, in a small envelope or a standard herbarium pocket made of cut and folded white paper. This pocket or envelope should be pasted in a corner of the mounting sheet with the folded, opened ends on the outside.

Transparent covers and specimen folders. Mounted sheets of fragile, rough, or valuable specimens can be placed in cellophane envelopes for protection from breakage (18). As cellophane may shrink slightly, the envelopes should be larger than the mounting sheets; about $\frac{1}{2}$ inch longer and $\frac{1}{2}$ inch wider. Pieces of cellophane or permacel can be sewed on mounting sheets to cover fruits and seeds which tend to break, spread, or shed, such as large grass awns or fragile flower heads, milkweed pods, etc. One region recommends covering the mounted sheet with plastacele, then edging with cloth and sewing securely, followed by arrangement in books of about 25 specimens. In the Forest Service Herbarium in Washington, D. C., each mounted sheet, with the exception of those preserved in cellophane envelopes, is placed in a folded sheet of newsprint, or specimen folder, for protection in handling.

Genus folder. Groups of several specimens (up to an inch or two in thickness) of the same species or genus are filed together in a buff cardboard folder known as a genus folder, 17 by 12 inches after folding, with the name of the genus on the outside near the lower edge. A genus folder can be pulled out easily from a herbarium case, while a single mounted sheet would be damaged if removed in this manner.

Herbarium cases. Mounted specimens are stored in suitable steel or wood herbarium cases or cabinets, where they may be readily consulted and will be safe from injury. In field herbaria the herbarium cases usually are of wood, with tightly fitting wooden or glass doors and divided by shelves and vertical partitions into pigeon holes approximately $12\frac{1}{2}$ inches wide, 19 inches long, and 6 inches high. An easy-to-get, economical, and convenient temporary herbarium case made up from corrugated cardboard cartons, is described and illustrated by Merrill (27). Such a case could prove useful for filing any specially assembled working or training collections of local plant specimens. Briefly, from Merrill's description, the

individual carton is made up of two parts: an outer box, open front and back, and about 19 inches (48 cm.) long, 14 inches (34.5 cm.) wide, and 9½ inches (24 cm.) high, outside measurements; a straight inner strip a little over 5 ft. (1.6 m.) long, and just wide enough to be bent, fitted and sealed (with water glass) inside the outer box in such a way as to form its back and front and to reinforce its side walls. The back of the box is sealed on the outside with 2-inch (5 cm.) kraft tape; the front is left open as a flap door, with the right side folded in about 2 inches. The outer box should project out beyond the flap door about a half-inch. Handles for opening the front flap can be improvised from curtain rings or pull clips. Of course, it is important to keep insect-repellents inside each carton.

Systems of filing mounted specimens in the herbarium. The simplest arrangement for small herbaria of field offices is that in which the identifications are reported from the Washington office, alphabetically by botanical names under each of the four forage groups. In larger herbaria the specimens are grouped together by plant families according to their classification and relationships. As most botanical manuals and floras have the families of seed plants in approximately the same order, the best published flora covering the particular region may be followed. Or, the families may be arranged alphabetically. Within a plant family the specimens may be filed either alphabetically by genera and species or in the sequence of the manual.

Dalla Torre and Harms system. Some large herbaria, including the U. S. National Herbarium and also the Forest Service Herbarium in Washington, D. C., and a few field herbaria, have adopted the Dalla Torre and Harms numerical system (7), which, however, is less practical for small herbaria. This system, like most botanical manuals, follows the arrangement of families and genera in the detailed many-volume work on the plant kingdom, *Die Natürlichen Pflanzenfamilien*, edited by A. Engler and H. Prantl. Each genus of seed plants, thus arranged according to relationships, bears a number. In the herbarium the specimens are filed by these numbers, which are placed on the genus folder before the generic name. This system is valuable in large herbaria, especially those with plants from many regions and from foreign countries, for bringing specimens of related genera together for study and identification. For small herbaria the Dalla Torre and Harms system has no obvious advantages over the sequence of the best regional manual and has certain disadvantages: (1) An alphabetical card index of genera with their numbers is required; (2) a few segregate genera and new genera are omitted and must be interpolated; and (3) this reference book must be consulted for numbers whenever additional genera are placed in the herbarium. Any field offices planning to adopt this system should request the loan, through the nearest branch library of the Department of Agriculture, of a copy of Dalla Torre and Harms (7) from the Department of Agriculture Library in Washington, D. C.

Indexes to the herbarium. Elaborate card indexes in a small herbarium are unnecessary, as the herbarium, properly arranged according to a definite system, is in itself an index or catalog. However, a card index of common names and botanical or scientific names may be useful to show quickly whether a species is represented and to indicate the location of

the specimen by compartment number. Cards for synonyms with cross references may be helpful in some cases. All the species of a genus may be listed on the same card, if desired. A simple index may be posted on the door of the herbarium case. Or, a copy of the best published flora of the region will serve as a guide, with the species in the herbarium checked both in the text and index. One regional office maintains a file consisting of an extra copy of each Form FS-767 which accompanies every specimen from the field.

Insect damage. Perhaps the simplest method of protecting small herbaria from insect damage is by means of chemicals such as paradichlorobenzene crystals or naphthalene (flakes and moth balls). Paradichlorobenzene is more effective than naphthalene but more expensive. These vaporizing chemicals should be placed near the top of each herbarium case in a small cheesecloth bag, small unsealed envelope, open tray, or trough (in metal cases) and replaced from time to time as needed. One of the insects that most commonly attacks dried plant specimens, mounted or unmounted, is the small brown cigarette beetle, or herbarium beetle, only 1/8 inch long. If these or other insects or evidence of their work, such as powder, are found on herbarium sheets, a few paradichlorobenzene crystals or naphthalene flakes should be distributed lightly among the mounted sheets of the case affected. Large herbaria have special but more complex methods (28). An electric heating cabinet designed by O'Neill (30), in which specimens can be placed for destruction of insects by heat, is used in the Forest Service Herbarium in Washington, D. C. Other methods which have been used in this herbarium in the past and which are adopted in some herbaria are poisoning specimens by immersion in corrosive sublimate solution before mounting and fumigation by carbon disulfide, which is placed in saucers in the case. Carbon disulfide kills insect pests but is a fire hazard.

Preservation of specimens in plastics. Special methods for the preservation of plant specimens in plastics have been described in detail by Fessenden (13). These include mounting in plastic plates of pressed specimens with natural color retained and the embedding of three-dimensional specimens, such as flowers, fruits, and seeds, in plastic blocks. However, these methods should be undertaken only by persons having a working knowledge of chemistry. Wherry (37) recently has reported a plastic spray under the name of Krylon, which will deposit a transparent, flexible film on herbarium sheets. Herbarium sheets coated with this plastic can be handled without damage or breakage.

Common Names

Lists of approved common names. The advantages of having uniform English names, or common names, of at least the most important genera and species are obvious; it is the policy of the Forest Service to promote, so far as practicable, the standardization of such names. The Forest Service approved common and scientific names of trees of the United States are those in the Check List of the Native and Naturalized Trees of the United States, including Alaska (16), mimeographed in 1944 and being revised for publication. Special Forest Service publications on western range plants are: Range Plant Handbook (10) and Important Western Browse Plants (8). Other standards for plant names, especially compounding, within the United States Government are: U. S. Government Printing Office Style Manual (Rev. ed., 435 pp. Washington. 1945; plant names, pp. 179-184) and Webster's

New International Dictionary (Ed. 2, 3210 pp., illus. Springfield, Mass. 1940). Any recommendations for changes or additions in common names in these references, including the regional lists mentioned below, should be submitted to the Washington office.

Regional lists of plant names. Each western region of the Forest Service has issued a list of the important plant species of its area with both scientific names and common names. In some lists standard symbols and plant-use factors are included. Certain experiment stations and regions have published keys for identification and popular tree guides also.

Standardized Plant Names. The second edition of Standardized Plant Names (25), though not officially adopted, is a valuable reference and is extensively in use in the Department of Agriculture and outside. Within this reference are many names of forest and range plants and also useful lists of grass genera, range plants, poisonous plants, weeds, and lumber trade names prepared by the Forest Service. The main object of this book is to list the standard names, both English and scientific, for all native or exotic plants known to be economically important or significant in this country. Though having about 90,000 entries, Standardized Plant Names cannot be considered an encyclopedia of all possible names used in the Forest Service, and, consequently, does not include many species represented in Forest Service collections.

Supplies and Equipment

Labels. Forest Service herbarium labels, Form FS-767 and Form FS-130 (and later, when ready, Form FS-707) can be obtained from the supply depot of the Forest Service at Government Island, Alameda, California.

Equipment for collecting and pressing specimens. Most of the special equipment used in collecting and pressing specimens can be purchased from botanical supply companies. Names of some of these companies will be furnished on request.

Supplies. Most supplies for pressing and mounting plant specimens are stocked in the Central Supply Section, Office of Plant and Operations, U. S. Department of Agriculture, Washington 25, D. C., from which they may be purchased by field offices east of the Mississippi River. Among these are the following items, listed by item number and name as in the catalog of that office: (1) 57-P-5790, Press, plant (without straps), 12 by 17 inches (2 units of frames must be ordered for 1 press). (2) 57-S-9600, Straps, plant-press, canvas, with tooth buckles, length 5 feet, width $1\frac{1}{4}$ inch (2 straps are needed). (3) 57-P-2440, Paper, blotting, herbarium, extra-heavy, lintless, 80-pound, gray, size $11\frac{3}{4}$ by $16\frac{3}{4}$ inches (these are thin absorbent blotters). (4) 53-P-17599, Paper, printing, newsprint, standard, white, $16\frac{1}{2}$ by 23 inches, sold by the pound, approximately 33 sheets. (5) 53-P-13790, Paper, ledger, white, rag (100%), substance 88, plain, $11\frac{1}{2}$ by $16\frac{1}{2}$ inches, use: herbarium (a thin mounting sheet). (6) 53-T-1280, Tape, linen, gummed, white, roll, width 2 inches, length 5 yards (white gummed cloth used for mounting strips). (7) 51-D-190, Paradichlorobenzene (dichlorobenzene, para), 1-pound jar. Genus folders, of buff cardboard 17 by 24 inches or 17 by 12 inches after folding can be purchased from botanical supply companies, paper companies, or printers.

Field offices west of the Mississippi River may purchase supplies from the closest Supply Center of the Bureau of Federal Supply, General Services Administration.

Herbarium cases. Blueprints and specifications for both wooden and metal herbarium cases are available in the Division of Dendrology and Range Forage Investigations in the Washington office. These may be borrowed upon request.

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